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ARMY AVIATION TEST BOARD FORT RUCKER ALA
COMPARATIVE EVALUATION OF HOMING ANTENNAS ON U-21 AIRCRAFT.(U)
MAR 68

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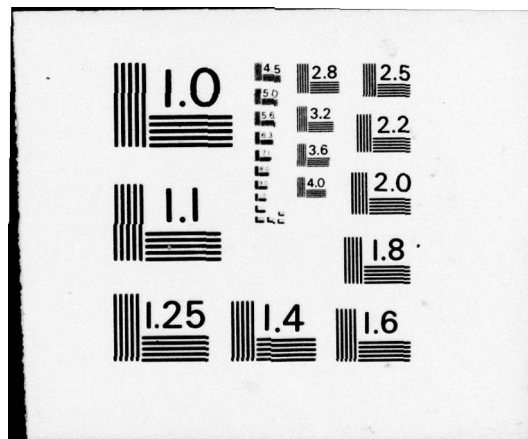
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DEPARTMENT OF THE ARMY
UNITED STATES ARMY AVIATION TEST BOARD
Fort Rucker, Alabama 36360

STEBG-TD

20 MAR 1968

SUBJECT: Special Report of Test, Comparative Evaluation of Homing
Antennas on U-21 Aircraft, USATECOM Project No. 4-7-
3692-02

TO: Commanding General
US Army Electronics Command
ATTN: AMSEL-RD-GTT
Fort Monmouth, New Jersey 07703

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1. Purpose. To compare the overall performance and characteristics of the Model A and Model B Homing Antennas on the U-21 aircraft.

2. Background. The homing antenna system initially employed by the Army was designated the AN/ARA-31 Homing Adapter and was used in conjunction with the AN/ARC-44 FM Radio Set. The AN/ARC-44, with its homing capability, was succeeded by the AN/ARC-54 FM Radio Set with the Model A Homing Antenna. The AN/ARC-54 was service tested in 1962 and was subsequently type classified. In March 1967, USATECOM directed the USAAVNTBD to service test the Model A Homing Antenna for use with the AN/ARC-54 and AN/ARC-131 VHF-FM radio sets (reference 1, inclosure 1). In June 1967, USATECOM further directed that, in conjunction with the service test, the Model B Homing Antenna be compared with the Model A using the U-21() aircraft as a test bed (reference 2, inclosure 1). This report contains the results of that comparison.

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3. Description of Materiel. Each antenna consists of two elements housed in a protective, shaped case. The Model A is 29 7/8 inches long, 7 1/2 inches high, and weighs 2 pounds 7 ounces. The Model B is 27 inches long, 6 1/2 inches high, and weighs 2 pounds, 2 1/2 ounces.

4. Scope. The USAAVNTBD tested the Model A and Model B Homing Antennas at Fort Rucker, Alabama, during the period 18 December 1967 through 9 February 1968. Each antenna was tested at the same frequencies using the U-21A airplane, the same radio sets (two AN/ARC-54 and one AN/ARC-131), and identical flight profiles. The following were evaluated:

- a. Installation.
- b. Performance.
- c. Maintenance.
- d. Personnel and training requirements.

Primary emphasis during the test was placed on performance. Homing and communication were conducted both concurrently and separately, inflight at absolute altitudes of 500 feet and 3,000 feet. An AN/VRC-46 radio was used as a ground station. Turns of 180 degrees (left 90 degrees to right 90 degrees from on-course) were made at 30-degree bank angles to determine the average range at which reliable homing and communications could be maintained.

5. Summary of Results.

a. The U-21 was factory-equipped with a Model B antenna. After this antenna was removed, installation of the Model A or reinstallation of the Model B required approximately one man-hour. An avionic mechanic, MOS 35K20, or an avionic communications equipment repairman, MOS 35L20, could install and remove either antenna.

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b. Homing and communication ranges obtained with each antenna and the AN/ARC-54 were:

Frequency (mhz)	Altitude (ft.)	Range (N. M.)	
		Model A	Model B
31.5	500	30	30
	3000	60	60
36.9	500	30	30
	3000	60+	60+
52.4	500	40	40
	3000	60+	60+
54.0	500	44	44
	3000	70+	70+

c. Ranges obtained with the AN/ARC-131 were less than with the AN/ARC-54. This decrease was not fully reduced to the test antenna or to the radio set. Only one AN/ARC-131 was available for test so no comparisons between sets could be made. The AN/ARC-131 was bench tested but no discrepancies were found in performance or sensitivity.

Frequency (mhz)	Altitude (ft.)	Range (N. M.)	
		Model A	Model B
31.5	500	18	18
	3000	20	20
36.9	500	18	18
	3000	22	22
52.4	500	20	20
	3000	25	25

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<u>Frequency (mhz)</u>	<u>Altitude (ft.)</u>	<u>Range (N. M.)</u>	
		<u>Model A</u>	<u>Model B</u>
54.0	500	20	20
	3000	35	35
74.0	500	22	22
	3000	40	40

d. False "on-course" indications were received at 90 degrees and 270 degrees from the correct heading on a frequency of 36.9 mhz. The false signals were acquired using either antenna at ranges up to one-half the maximum homing range. No false indications were received on other frequencies tested.

e. Homing to other aircraft was accomplished satisfactorily using either antenna. The direction to and the direction of movement of the transmitting aircraft were easily determined.

f. The pilot and copilot could not obtain homing indications simultaneously. If both indicators were set on "home" position, neither would operate.

g. No maintenance was required on either antenna during the test period.

h. Pilots required a 30-minute orientation on homing procedures using the homing antennas with the AN/ARC-54 or AN/ARC-131. Avionic mechanics, MOS 35K20, and avionic communications equipment repairmen, MOS 35L20, familiar with the AN/ARC-54 or AN/ARC-131 required no additional training for installation and troubleshooting.

6. Discussion.

a. Frequencies between 54.0 mhz and 74.0 mhz were not authorized for test because of possible interference to VHF TV audio channels. Frequencies from 69.9 mhz to 74.0 mhz were only available on the

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AN/ARC-131 which was a test receiver. Test results indicated that the antennas are most sensitive at those frequencies, which could result in false on-course indications.

b. On the basis of the ranges obtained during the test, both antennas appear to be incompatible with the AN/ARC-131. This could not be confirmed since only one AN/ARC-131 was available. Additional testing will be necessary to determine the reason for the short range.

7. Conclusions.

a. The Model A and Model B Homing Antennas, when installed on the U-21 aircraft, are equal in performance and other characteristics.

b. False on-course indications may force a restriction on both antennas from use at some frequencies.


c. Each antenna may be incompatible with the AN/ARC-131.

d. Until these problems are resolved, neither of the antennas is suitable for use on the U-21() airplane.

8. Recommendation. It is recommended that the false on-course indications and the short range resulting from use of the antennas with the AN/ARC-131 be investigated further.

2 Incl

1. References
2. Code Sheet


DAVID M. KYLE
Colonel, Artillery
President

Copies furnished:

CG, USATECOM, ATTN: AMSTE-BG,
Aberdeen Proving Ground, Maryland 21005 (2 cys)

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REFERENCES

1. Letter, AMSTE-BG 4-7-3692-01/02, Headquarters, US Army Test and Evaluation Command, 29 March 1967, subject: "Test Directive, Engineering and Service Test, [Model A] Homing Antenna for AN/ARC-54 and AN/ARC-131."
2. Letter, AMSEL-RD-GTT, Headquarters, US Army Electronics Command, 22 May 1967, subject: "Engineering and Service Test of [Model A] Homing Antenna, USATECOM Project No. 4-7-3692-01/02," with 1st Indorsement, AMSTE-BG (22 May 67), Headquarters, US Army Test and Evaluation Command.
3. Letter, AMSTE-BG, Headquarters, US Army Test and Evaluation Command, 21 June 1967, subject: "Service Test of [Model A] Homing Antenna, USATECOM Project No. 4-7-3692-02."
4. Plan of Test, USATECOM Project No. 4-7-3692-02, "Service Test of [Model A] Homing Antenna for AN/ARC-54 and AN/ARC-131," US Army Aviation Test Board, 26 July 1967.

INCLOSURE 1

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